7.2-Sets

Thursday, November 2, 2017 8:28 AM

Goals: (1) Understand Set Notations

(2) Perform Operations on sets

(3) Solve some applications

Definition of a set:

A set is a collection of objects

E.g.

$A = \{1, 2, 3\}$ ← listing method.

$B = \{a, b, c, d, e, f\}$

$C = \{\text{Jan}, \text{Feb}, \text{Mar}, \text{May}, \text{Jun}, \text{Nov}\}$

$\mathbb{R}$ = set of all real numbers.

$\mathbb{Z}$ = set of all integers.

Notation: $e \in A$

This notation means that e is an element of the set A.

E.g. $A = \{1, 2, 3\}$

$1 \in A$. $2 \in A$. $3 \in A$.

$B = \{$ all states in the U.S $\}$

$TX \in B$, $CA \in B$, $AZ \in B$.

$\mathbb{Z}$. $-100 \in \mathbb{Z}$, $10402 \in \mathbb{Z}$.

Notation: $e \notin A$.

This means that e is NOT an element of the set A.

$A = \{1, 2, 3\}$. $6 \notin A$.

$B = \{$ all States in the U.S $\}$.

$10 \notin B$; China $\notin B$

$\mathbb{Z}$. $\frac{3}{5} \notin \mathbb{Z}$.

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Empty Set or Null Set

E.g. Describe the set of real numbers that are the solution to the equation.

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$x = \pm\sqrt{-1}$$

No real solutions.

The solution set of this equation has no elements in it. It is the empty set or the null set.

Notation for the empty set: $\emptyset$

Set Builder Notation.

$A = \{a, b, c, d, \ldots, z\}$ ⟶ listing method

Instead of using the listing method, we can use set builder notation to describe the set.

$A = \{ x \mid x \text{ is a letter of the English alphabet} \}$

read as "such that"

$B = \{ x \mid x \text{ is a month in the year} \}$

$C = \{ x \mid x \text{ is a rational number} \}$

Subsets

Definition: A and B are sets.

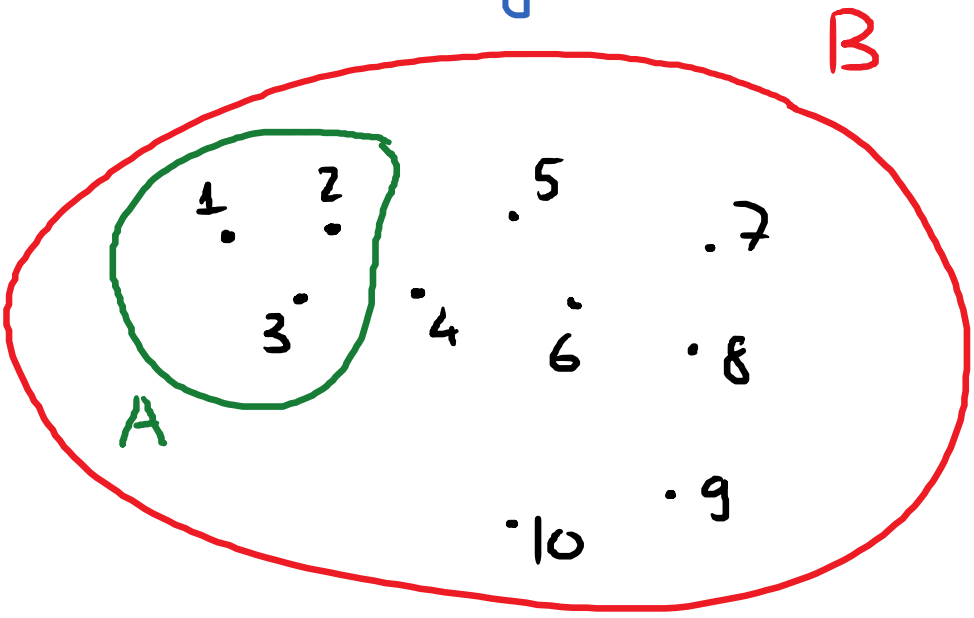
We say that A is a subset of B if every element of A is also an element of B

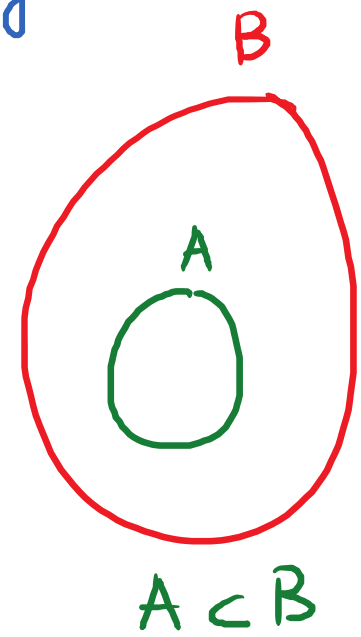
E.g. $A = \{1, 2, 3\}$. $B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

A is a subset of B.

Notation for subset: $A \subset B$

To visualize sets and the relations among sets, we can use Venn Diagram.





Note: ϕ is a subset of every set.

Ex. $A = \{1,2,3\}$.

Find all the subsets of this set.

ϕ, $\{1\}$, $\{2\}$, $\{3\}$, $\{1,2\}$, $\{1,3\}$;

$\{2,3\}$, $\{1,2,3\}$ → 8 subsets

Ex. $B = \{1,2,3,4\}$ → 16 subsets.

ϕ, $\{1\}$, $\{2\}$, $\{3\}$, $\{4\}$, $\{1,2\}$, $\{1,3\}$, $\{1,4\}$,

$\{2,3\}$, $\{2,4\}$, $\{3,4\}$, $\{1,2,3,4\}$

$\{1,2,3\}$; $\{2,3,4\}$, $\{1,2,4\}$, $\{1,3,4\}$

Ex. $C = \{1,2,3,4,5\}$ → How many subsets?

32 subsets